

Treatment of Calcifying Tendinitis of the Shoulder With Shock Wave Therapy

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In a prospective clinical study, the effectiveness of shock wave treatment for calcifying tendinitis in 31 shoulders in 29 patients (14 women and 15 men) with an average age of 52 years was assessed. Each shoulder was treated with 1000 impulses of shock waves at 14 kV. A 100-point Constant score system was used for evaluation. The overall results of 20 patients (21 shoulders) with 12 weeks followup were no complaints in 23.8%, significantly improved in 38.1%, some improvement in 14.3%, and unchanged in 23.8%. Considerable improvement was observed between 6 and 12 weeks. The results of seven patients with 24 weeks followup were no complaints in two patients, significantly improved in three, and unchanged in two patients. Radiographs showed complete elimination of the calcium deposits in six patients (28.6%), incomplete elimination in two patients (9.5%), and three patients (14.3%) had fragmentation

of the calcium deposits. There was no recurrence of calcium deposits observed at 24 weeks. There was a correlation between the functional improvement and the elimination of calcium deposits. There were no device-related problems, systemic or local complications. Low-energy shock wave therapy may offer a new and safer additional nonoperative treatment for patients with calcifying tendinitis of the shoulder.

The etiology and pathogenesis of calcifying tendinitis of the shoulder remain unclear. Hypovascularization in the rotator cuff, degenerative changes, and a metabolic disturbance have been suggested as possible causes.^{4,5} Chondroid metaplasia may lead to a calcification of tendon tissue.¹¹ In many patients, calcification may remain asymptomatic depending on position and size, yet sometimes may cause impairment of mechanical function and severe pain. It is not uncommon for patients with calcifying tendinitis to have long-term pain at rest and with movement. Treatment of patients with calcifying tendinitis of the shoulder ranges from physiotherapy, nonsteroidal antiinflammatory drugs, xray treatment, and steroid injection to surgical intervention with the intention of removing the calcium deposits and decompressing the subacromion space. The effects of different treatments vary significantly and do not show consistent and reliable long-term results.

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Shock wave therapy has been shown to be effective in the treatment of nonunions of long bone fractures, lateral epicondylitis of the elbow, calcifying tendinitis of the shoulder, and for relief of chronic pain in the heel and elbow.^{6,8,9,12} Shock wave therapy provides a potential new treatment modality for calcifying tendinitis of the shoulder. The current authors reviewed the early clinical results of 31 shoulders in 29 patients with calcifying tendinitis treated with shock waves.

MATERIALS AND METHODS

The inclusion criteria included patients with painful shoulders attributable to calcifying tendinitis. These patients did not respond to at least 6 months of conservative treatments and otherwise might have considered surgery as an alternative. Conservative treatments included nonsteroidal antiinflammatory drugs, corticosteroid injection, physical therapy, exercise program, and immobilization of the shoulder in a sling. The exclusion criteria included patients with a history of recent trauma or local infection, immunosuppressant drugs, cardiac arrhythmia or pacemaker, pregnancy, skeletally immature patients, and patients with rotator cuff tears or proven arthritis of the shoulder. Between August 1998 and May 1999, 29 patients (31 shoulders) with pain attributable to calcifying tendinitis of the shoulders were treated with shock waves using an OssaTron (High Medical Technology, Kreuzlingen, Switzerland). In two patients, both shoulders were treated. There were 14 women and 15 men with an average age of 52 years (range, 36–66 years). The right shoulder was affected in 18 patients (19 shoulders) and the left shoulder was affected in 11 patients (12 shoulders). The average duration of the condition was 9 months (range, 6–24 months). Approximately 1/2 of the patients also received treatment with herbal medicines. All patients discontinued their current treatment including nonsteroidal antiinflammatory drugs for 2 weeks before treatment. Informed consent was obtained and potential risks were explained to the patients according to the study protocol. The outpatient treatments were provided under local anesthetic with 2% xylocaine. Patients were placed in a supine position and the OssaTron tube was focused on the treatment area with a control guide. Each patient received 1000 impulses of shock waves at 14 kV (0.18 mJ/mm² energy flux

density) generator voltage. Ten patients also received a second treatment 30 to 60 days after the first treatment. During treatment, vital signs and local symptoms were monitored carefully. Approximately 2/3 of the patients experienced some discomfort at the treatment site. There were no systemic or local complications such as ecchymosis, swelling, or hematoma for which the patients required special treatment. Five patients had local reddening that resolved spontaneously after 48 hours. Patients were sent home with an ice pack and nonnarcotic analgesics. Nonsteroidal antiinflammatory drugs were not prescribed. Patients were allowed to use the affected arm in the usual fashion. Followup examinations were scheduled 6, 12, and 24 weeks after treatment.

A 100-point Constant score system that included 15 points for pain, 20 points for activities of daily living, 40 points for shoulder motion, and 25 points for the power of the affected arm was used.³ The evaluation parameters included the intensity of pain during the day and at night, the percentage of power of the affected arm as compared with the opposite arm, restriction of daily activities, and range of shoulder motion. The intensity of pain was measured with a visual analog scale from 0 to 10 points. Patients who did not have pain received 10 points and patients with severe pain received 0 points. The visual analog scale scores were reversed to maintain a consistent scoring system in the current study. It did not alter or affect the statistical significance. Radiographs of the shoulder were taken at each followup to evaluate the status and the size of the calcium deposits.

RESULTS

Four patients (four shoulders) were excluded because of inadequate followup and lack of evaluation scores. The remaining 25 patients (27 shoulders) were included in the analysis 6 weeks after treatment. The scores before and after treatment were compared statistically using a Wilcoxon signed rank test and statistical significance was set at a *p* value of < 0.05. The intensity of pain was 3.5 ± 1.6 before treatment and 6.2 ± 2.1 after treatment (*p* < 0.001). The pain scores were 3.9 ± 1.7 before treatment and 6.4 ± 2.1 after treatment (*p* < 0.001). The percentage of power of the affected arm was 7.7 ± 2.6 before treatment as

opposed to 15.4 ± 6.3 after treatment ($p < 0.001$). The scores for daily activities were 9.1 ± 3.7 before treatment as opposed to 14.0 ± 4.2 after treatment ($p < 0.001$). The difference in the scores before and after treatment for shoulder motions including forward elevation, lateral elevation, and external and internal rotations was statistically significant ($p < 0.05$). The total Constant scores were 50.8 ± 13.9 before treatment and 73.5 ± 17.2 after treatment ($p < 0.001$). The results of various scores at 6 weeks are summarized in Tables 1A and 1B. The overall results at 6 weeks were no complaints in one patient (3.7%), significantly improved in 16 patients (59.3%), some improvement in three patients (11.1%), and unchanged in seven patients (25.9%). No patient complained of symptoms worsening.

The average size of the calcium deposit shown on radiographic examination was 11.0 ± 6.2 mm (range, 3–30 mm) before treatment versus 8.6 ± 7.2 mm (range, 0–25 mm) after treatment ($p = 0.017$). Complete elimination of the calcium deposits was observed in seven patients, incomplete elimination was observed in four patients, and two patients had fragmentation of the calcium deposits. The largest size of the calcium deposit that was eliminated after shock wave therapy was 20 mm. Two case examples are shown in Figures 1 and 2.

Twenty patients with 21 shoulders were assessed at 12 weeks after treatment. The difference between scores before and after treatment were compared statistically using a Wilcoxon signed rank test and statistical significance was set at a p value of < 0.05 . The intensity of pain

TABLE 1A. The Results of Evaluations at 6 Weeks

Evaluation Scores	Before Treatment	After Treatment	p Value
Number of patients/shoulders	25/27	25/27	
Intensity of pain	3.51 ± 1.6 (range, 0–8)	6.2 ± 2.1 (range, 2–10)	< 0.001
Pain scores	3.9 ± 1.7 (range, 0–8)	6.4 ± 2.1 (range, 2–10)	< 0.001
Power scores	7.7 ± 2.6 (range, 2–12)	15.4 ± 6.3 (range, 2–25)	< 0.001
Activity scores	9.1 ± 3.7 (range, 5–20)	14.0 ± 4.2 (range, 5–25)	< 0.001
Constant scores	50.8 ± 13.9 (range, 4–70)	73.5 ± 17.1 (range, 35–98)	< 0.001

TABLE 1B. The Scores for Shoulder Motion at 6 Weeks

Shoulder Motion Scores	Before Treatment	After Treatment	p Value
Number of patients/shoulders	25/27	25/27	
Forward elevation	8.2 ± 2.3 (range, 0–10)	9.3 ± 1.4 (range, 6–20)	0.002
Lateral elevation	7.6 ± 2.1 (range, 0–10)	9.3 ± 1.3 (range, 6–10)	0.001
External rotation	6.3 ± 3.1 (range, 0–10)	8.4 ± 2.4 (range, 2–10)	0.001
Internal rotation	5.2 ± 2.4 (range, 0–10)	6.9 ± 2.2 (range, 2–10)	0.010

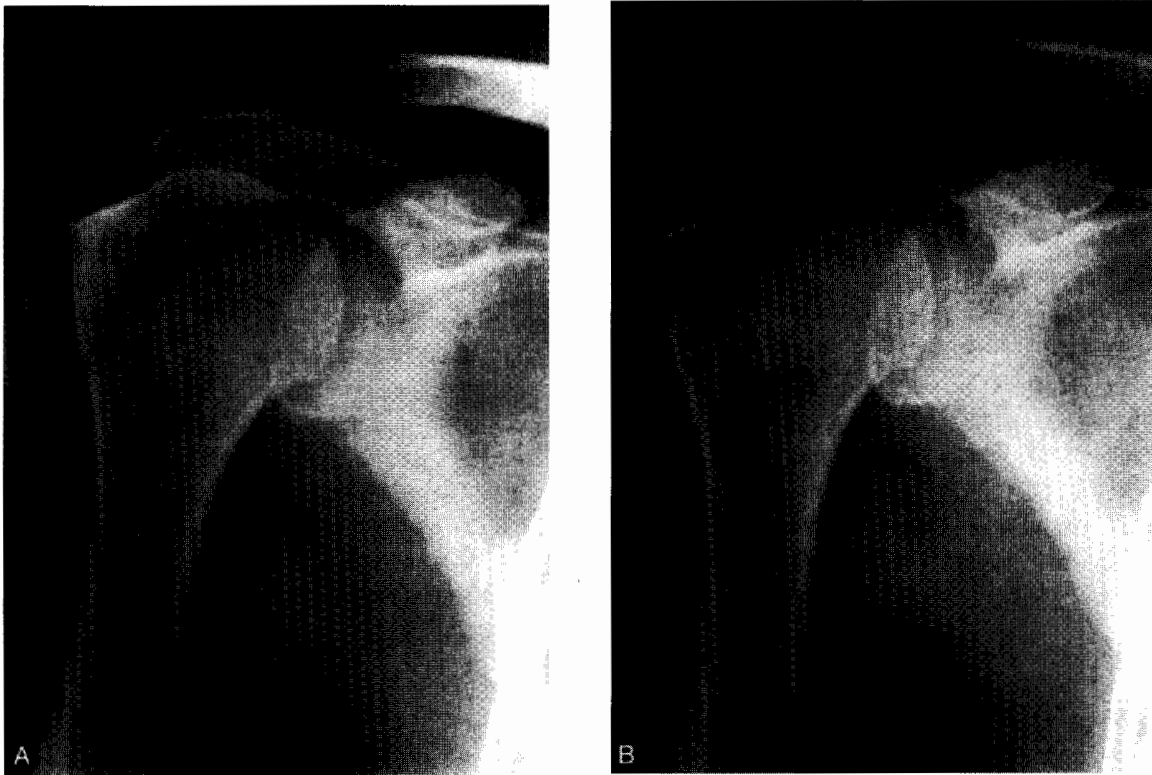


Fig 1. Case example.

was 3.5 ± 1.8 before treatment versus 6.2 ± 2.4 after treatment ($p = 0.001$). The pain scores were 4.0 ± 1.8 before treatment and 6.7 ± 2.2 after treatment ($p < 0.001$). The percentage of power on the affected arm was 8.1 ± 2.5 before treatment versus 16.7 ± 6.8 after treatment ($p = 0.001$). The scores for various activities of daily living were 9.4 ± 3.6 before treatment and 15.8 ± 4.4 after treatment ($p = 0.001$). The difference between shoulder motions in forward elevation, lateral elevation, and internal and external rotations before and after treatment was statistically significant ($p < 0.05$). The total Constant scores were 51.7 ± 15.1 before treatment and 77.3 ± 18.9 after treatment ($p < 0.001$). The results of various scores at 12 weeks are summarized in Tables 2A and 2B. The overall results at 12 weeks were excellent in five patients (23.8%), significantly improved in eight patients (38.1%), some improvement in three patients (14.3%), and unchanged in five patients (23.8%). No patient's symptoms became worse.

The average size of the calcium deposits on radiographic examination was 11.3 ± 6.8 mm (range, 3–30 mm) before treatment versus 8.7 ± 8.4 mm (range, 0–30 mm) after treatment ($p = 0.024$). Eight patients (38%) had elimination of the calcium deposits, six had complete elimination, and two had partial elimination. There was no recurrence of calcium deposits from 6 to 12 weeks. In addition, three patients had fragmentation of the calcium deposits. Four of six patients with complete elimination of the calcium deposits did not have any complaints and had normal Constant scores, whereas two patients had mild pain and had a Constant score of 82. Two patients with partial elimination showed significant improvement. In the three patients with fragmentation of the calcium deposits, one did not have complaints, one remained moderately symptomatic, and one had recurrent pain develop. There was a correlation between the elimination of the calcium deposits and the functional improvement.

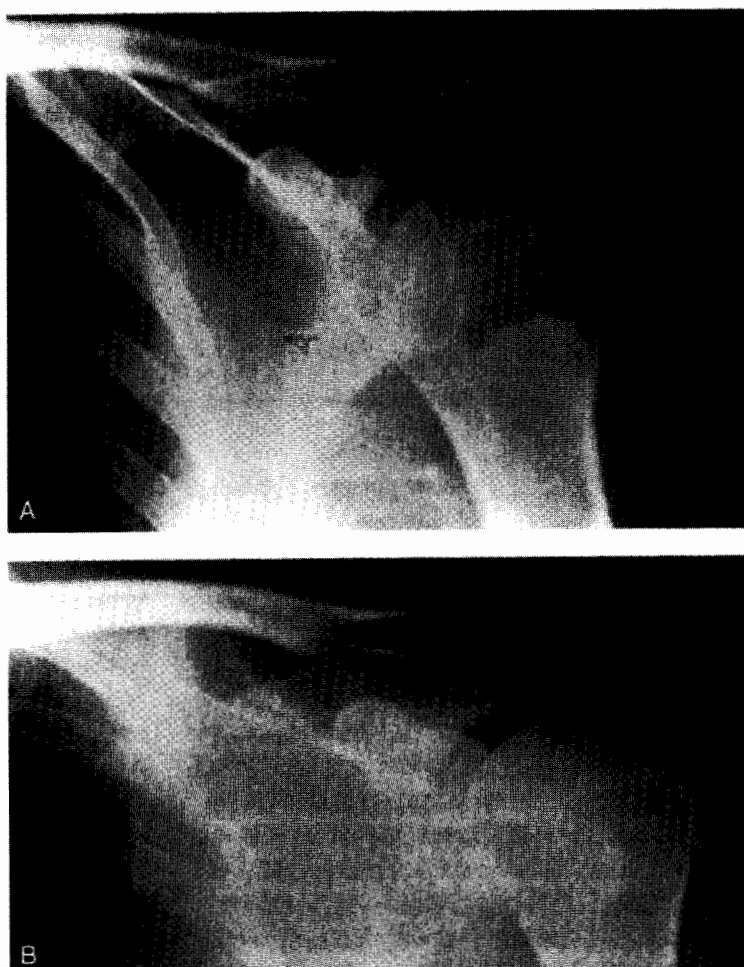


Fig 2. Case example.

Seven patients (seven shoulders) had completed followups at 6 to 9 months and their results were analyzed with a Wilcoxon signed rank test with a statistical significance at a p

value of < 0.05 . The intensity of pain was 3.3 ± 1.9 before treatment versus 6.9 ± 2.9 after treatment ($p = 0.043$). The pain scores were 4.3 ± 1.8 before treatment and 7.3 ± 3.0 after treat-

TABLE 2A. The Results of Evaluations at 12 Weeks

Evaluation Scores	Before Treatment	After Treatment	p Value
Number of patients/shoulders	20/21	20/21	
Intensity of pain	3.5 ± 1.8 (range, 0-8)	6.2 ± 2.4 (range, 2-9)	< 0.001
Pain scores	4.0 ± 1.8 (range, 0-8)	6.7 ± 2.2 (range, 2-10)	< 0.001
Power scores	8.1 ± 2.5 (range, 2-12)	16.7 ± 6.8 (range, 5-25)	0.001
Activity scores	9.4 ± 3.6 (range, 2-15)	15.8 ± 4.4 (range, 5-20)	0.001
Constant scores	51.7 ± 15.1 (range, 4-78)	77.3 ± 18.9 (range, 22-100)	< 0.001

TABLE 2B. The Scores for Shoulder Motion at 12 Weeks

Shoulder Motion Scores	Before Treatment	After Treatment	p Value
Number of patients/shoulders	20/21	20/21	
Forward elevation	8.3 ± 2.5 (range, 0–10)	9.5 ± 0.9 (range, 8–10)	0.014
Lateral elevation	7.6 ± 2.3 (range, 0–10)	9.2 ± 7.6 (range, 6–10)	0.005
External rotation	6.1 ± 3.4 (range, 0–10)	8.2 ± 2.5 (range, 2–10)	0.006
Internal rotation	5.1 ± 2.4 (range, 0–10)	7.3 ± 2.3 (range, 2–10)	0.007

ment ($p = 0.042$). The score for power of the affected arm was 8.6 ± 2.0 before treatment versus 17.7 ± 8.7 after treatment ($p = 0.042$). The scores for daily activities were 10.0 ± 3.7 before treatment and 15.3 ± 5.8 after treatment ($p = 0.043$). The total Constant scores were 51.6 ± 12.9 before treatment and 76.9 ± 29.0 after treatment ($p = 0.046$). Although the numbers were too small for definite conclusions, the overall results were no complaints in two patients (28.6%), significant improvement in three patients (42.8%), and unchanged in two patients (28.6%). No patient's symptoms became worse. It seemed that the effects of shock wave on calcifying tendinitis of the shoulder continued from 12 to 24 weeks. There were no device-related problems, and no systemic or local complications.

The average size of the calcium deposits were 11.4 ± 4.9 mm before treatment and 4.2 ± 6.1 mm after treatment ($p = 0.068$). Four of seven patients (56%) had complete elimination of the calcium deposits. Three of these four patients did not have calcium deposits since the calcium deposits were eliminated at 6 weeks. In one patient, elimination of the calcium deposit occurred gradually between 12 to 24 weeks after treatment. It seemed that the calcium deposits did not recur once they were eliminated after shock wave treatment.

DISCUSSION

The exact cause of calcifying tendinitis of the shoulder is unknown, although a degenerative

process with an inflammatory reaction may play an important role.^{1,4,5,11} The relationship of the calcium deposit to shoulder pain is unclear. The goals of treatment are to alleviate pain and restore function of the shoulder. The results from conservative treatment for calcifying tendinitis of the shoulder varied considerably.¹¹ Likewise, the results of surgery also were inconsistent although satisfactory results were reported in as many as 91% of patients.² In patients in whom conservative treatment has failed, surgery was considered as the alternative, but its success rate varied considerably as compared with the results of shock wave therapy. Surgery still can be done if shock wave therapy fails.⁸

The mechanism of shockwave therapy is not known. However, the value of shock wave treatment was proven in the treatment of patients with fracture nonunions with a 75% success rate^{9,12} and there was a positive effect in patients with tennis elbow, painful heel, and calcifying tendinitis of the shoulder.^{6-10,12} Spindler et al¹⁰ reported complete pain relief and full shoulder movement in three patients 2 years after shock wave therapy, and fragmentation of calcification was achieved after 24 hours. Loew and Jurgowski⁷ treated 20 patients with two sessions of 2000 impulses each of shock wave and reported a marked reduction of symptoms with an average of 30% improvement in the Constant score at the 12-week followup. Radiographs showed complete elimination of the calcification in seven patients and partial elimination in five pa-

tients. Magnetic resonance imaging did not show any lasting damage to bone or soft tissue. Rompe et al⁸ reported significant improvement of subjective and objective criteria, in which 72.5% of the patients had no or only occasional discomfort, and only six (15%) of 40 patients treated with 1500 shock waves reported no improvement. Complete or partial disintegration of the calcium deposits was observed in 62.5% of the patients.

The early clinical results of the current study were very encouraging with 63% of patients having complete or nearly complete resolution and 11% of patients having partial improvement by 6 weeks. The results at 12 weeks showed complete or nearly complete resolution in 61.9% of patients and partial improvement in 14.3%. In addition, complete or nearly complete resolution was seen in 71.4% of the patients at 6 months. The results are comparable with the results of other reported series.^{6-8,10} There was no device-related problems and no systemic or local complications. The authors observed that after shock wave treatment for calcifying tendinitis of the shoulder, the improvement was consistent and long-lasting. Currently, continuation of improvement beyond 6 months is uncertain because the number of patients for followup longer than 6 months was too small for statistical significance.

Complete elimination of the calcium deposits was seen in seven patients (26%), partial elimination was seen in four patients (15%), and fragmentation or disintegration of the calcium deposits was observed in two patients (7.4%) at 6 weeks. At 12 weeks, six patients (28.6%) had complete elimination, two patients (9.5%) had partial elimination, and three patients (14.3%) had fragmentation. Four of seven patients (57%) had complete elimination of the calcium deposits by 6 months. Three of these four patients had the calcium deposits eliminated at 12 weeks. Elimination of the calcium deposit was observed as early as 6 weeks although the exact time was not clear. There is a correlation be-

tween improvement in pain and function of the shoulder and elimination of the calcium deposits. In addition, it seemed that elimination of calcium deposits was consistent and long-lasting and no recurrences were observed by 6 months.

Treatment of patients with calcifying tendinitis of the shoulder with shock waves has produced a high rate of success in pain relief and functional restoration and negligible complications. Approximately 57% of the patients had complete elimination of the calcium deposits. Shock wave therapy is a new therapeutic modality that is safe and effective in the treatment of patients with calcifying tendinitis of the shoulder.

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